

**M.Tech. IN ADVANCED INFORMATION
TECHNOLOGY - INTELLIGENT SYSTEMS AND
ROBOTICS (MTECHSR)**

00264

Term-End Examination

December, 2014

MINI-002 : EMBEDDED SYSTEM DESIGN

Time : 3 hours

Maximum Marks : 100

Note :

- (i) *Section I is **compulsory**.*
- (ii) *In Section II, attempt any **five** questions.*
- (iii) *Assume suitable data wherever required.*
- (iv) *Draw suitable sketches wherever required.*
- (v) *Italicized figures to the right indicate maximum marks.*
- (vi) *Use of calculators is allowed.*
- (vii) *See the end of the question paper for reference data.*

SECTION I

1. An automated bot has to do the following tasks inside a large rectangular hall. Assume that it starts moving from one of the corners.

- (a) It should move to the rest of the three corners and come back to the original position.
- (b) At each corner, it should measure the temperature.
- (c) It has to send status signal to the base station to turn on / turn off the corresponding air-conditioner depending on the temperature.
- (d) The hall temperature should be maintained at 21 degrees Celsius.

Give a detailed design description with pseudo-codes, schematic, important considerations, desired sensor characteristics and assumptions, if any.

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SECTION II

2. (a) What are the different ways to pull up a pin on the controller? 7
- (b) Describe an application where pull-up is used in controllers. Explain with a circuit diagram. 7
3. USART is one of the classic old-time methods of communications still used in the industry.
- (a) Give a brief description of the RS 232 protocol. 8
- (b) Differentiate between bit rate and baud rate. 2
- (c) Can bit rate and baud rate be same for a given system? Justify. 4
4. (a) Describe the process of compiling programs and flashing the AVR using a makefile. 7
- (b) Describe the working of a Servo-Motor. 7
5. A controller works at a default frequency of 1 MHz. The maximum baud rate at this frequency is 4800. The on-board ADC is sampling data at 8000 samples per second. The USART working at 4800 baud cannot transmit all the sampled data from the controller to the PC. How can the baud rate of the USART be increased?
- Give details of the external components, internal register settings and circuit diagram. 14

6. (a) What is the advantage of using an Interrupt in embedded systems and how are they implemented ? 6
- (b) Write a function in embedded C for initializing and starting the 8-bit timer of the Mega8, which toggles an LED at a delay of 0.5 sec. 8
7. Write short notes on any *two* of the following : $2 \times 7 = 14$
- (a) Pulse Width Modulation
- (b) Brown Out Detector
- (c) Watch Dog Timer
8. A controller has to drive a 2D LED matrix with the help of 8-bit shift registers. Give the circuit diagram, design considerations and program for the same. 14

Following data is available for reference :

Register UCSRB has bits RXEN, TXEN

Register UCSRC has bits URSEL, UCSZ0, UCSZ1

Other Registers Available : UBRRL, UBRRH

Conditions applicable :

while ((UCSRA & (1 << UDRE)) == 0)

while ((UCSRA & (1 << RXC)) == 0)

Register ADCSRA has bits ADPS2, ADPS1, ADPS0 for setting prescaler (assume 111 as the required prescaler).

Register ADMUX has bit REFS0 which when **SET**, makes ADC reference to AVCC.

Register ADMUX has bit ADLAR which when **SET**, Left adjust ADC result to allow easy 8-bit reading.

Register ADCSRA has bit ADFR, which when **SET**, puts ADC to Free-Running Mode.

Register ADCSRA has bit ADEN, To enable ADC when **SET**.

Register ADCSRA has bit ADSC, To start ADC conversions when **SET**.

Register ADMUX (Lower 3 Bits) are used to select ADC channel.

Conditions applicable :

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while(bit_is_set(ADCSRA,ADSC));
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Register TIMSK has bit TOIE0, when **SET**, enable timer overflow interrupt for Timer0.

Register TCNT0, for setting Timer0 initial 1 value

Register TCCR0 has bits CS01 and CS00, when **SET**, starts the timer with 64-bit prescaler.

TIMER0_OVF_vect, is the timer0 overflow vector.
